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Arsenic in Private Well Water: Frequently Asked Questions

Arsenic occurs as a contaminant in some groundwater in Massachusetts, most frequently in the central part of the state. Drinking water from bedrock wells, also called drilled or artesian wells, and less frequently from shallow or dug wells, may contain arsenic.

Where does arsenic come from?

Arsenic (chemical symbol As) occurs naturally in soil and bedrock in many parts of the United States, including parts of Massachusetts. During the 1800s it was mined commercially in New Hampshire, but since 1985 arsenic used in the U.S. has been imported. Activities that could have left arsenic residuals include apple orchard spraying, coal ash disposal, and use of some pressure treated wood. Arsenic has no smell, taste, or color when dissolved in water, even in high concentrations, and therefore only laboratory analysis can determine the presence and concentration of arsenic in water.

If you are in an area of concern, MassDEP recommends that you sample for arsenic. The cost for a homeowner to test for arsenic at a Massachusetts lab may range from $12 to $24. Arsenic concentrations are often reported in milligrams of arsenic per liter of water (a liter is about a quart). The current drinking water standard is 0.010 mg/l or parts per million (ppm). This is equivalent to 10 ug/l or 10 ppb.

How can arsenic affect my health?

Arsenic ingestion can result in both chronic and acute health effects. Acute effects can include nausea vomiting, fatigue, "pins and needles" sensations in the hands and feet, or abnormal bruising. Chronic effects include an increased risk of skin, bladder, and lung cancer. Your health risks are determined by the following factors:

- the concentration of arsenic in your water,
- the amount of water you consume each day,
- the length of time you have been consuming the water, and
- your individual sensitivity to arsenic.

Based on reviews by health officials the following is recommended:

- Arsenic levels above 200 ppb: This level is a cause for concern and it is strongly suggested that you obtain your drinking water from another source immediately that is known to have no detectable arsenic, or install and maintain a home treatment device.
- Arsenic levels from 10 ppb to 200 ppb. Levels in this range will increase the risk of long term or chronic health problems. The higher the level the greater the risk. Don't panic-remember chronic conditions develop over a long period of time. Make plans to obtain water from another source, or install and maintain treatment.
- Arsenic levels from 3 ppb to 10 ppb. If you have levels in this range you may want to obtain drinking water from another source or install treatment, especially if you have small children or are pregnant. Data suggests that arsenic may affect small children differently than adults. Arsenic has been found in mother's milk and will cross the placenta, both of which may affect the development of the child.

What about bathing/showering, or other uses?

Unless your arsenic level is over 500 ppb, showering, bathing and other household uses are safe. Arsenic is not easily absorbed through the skin and does not evaporate into the air.

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What can I do if my water has high arsenic levels?

If the arsenic level in your well water is above 10 ppb there are a number of treatment methods available. However, before selecting a treatment method there are a number of factors that need to be considered.

First, there are typically two variations, or species, of arsenic in water: "arsenic 3" and "arsenic 5." This is significant because "arsenic 3" is very difficult to remove from water and must be changed or "oxidized" to "arsenic 5" before it can be removed. A laboratory can determine how much of each kind of arsenic is in your water, and the method is called "speciation." Speciation will add additional cost to the analysis. Ask the laboratory what they require for this process as it may require additional samples. Oxidants that can convert arsenic 3 to 5 include: liquid chlorine (bleach), hydrogen peroxide, and ozone. Chlorine is the most readily available oxidant for home water treatment.

The second factor is whether you want point-of-use (at the tap) treatment that is installed under the kitchen sink and has a special tap for drinking water, or whole house treatment that treats all the water that enters the house. The third factor is the possibility of other constituents, such as iron and manganese, which might hinder the effectiveness of arsenic removal and will need to be removed before the arsenic treatment. Arsenic removal methods or systems include anion exchange, reverse osmosis, activated alumina, and iron oxide filters. Each method has its advantages and disadvantages. Information on these treatment methods is listed below:

Anion exchange units operate using the same principle as a water softener. In this case the arsenic is exchanged for chloride. The systems are generally used to treat water for the entire house and require very little maintenance.

Reverse osmosis (RO) is generally installed as a point-of-use treatment system and usually requires pre-filtration to remove sand and grit that might foul the RO membrane. The cost of these systems is usually between $800 and $1,500. Costs can vary depending on water chemistry. RO is considered ineffective at removing arsenic 3.

Iron oxide filters are a relatively new treatment method, which looks promising. It is effective for both species of arsenic, and can be used for point-of-use treatment or whole house treatment. In addition the used resin can be disposed of as a non-hazardous waste.

Activated alumina (AA) is one type of adsorptive media for removing arsenic from water. This system will not remove arsenic 3. The efficiency of removal is dependent on the pH of the water, and may require pre-treatment to adjust pH. This treatment system, consisting of a single AA cartridge with a pre-oxidation cartridge costs approximately $350. There is an ongoing cost of replacing the cartridges about every six months. Systems can be designed for point-of-use or whole house treatment and the used media can be disposed of as a non-hazardous waste.

A list of MassDEP CERTIFIED laboratories can be accessed at the Department's website.

The Department recommends that you contact your local Board of Health if you have any additional questions.